

Research Trends

Volume 1
Issue 35 *Developing Research in Developing
Countries*

Article 2

12-1-2013

The bibliometrics of the developing world

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Recommended Citation

Huggett, Sarah (2013) "The bibliometrics of the developing world," *Research Trends*: Vol. 1 : Iss. 35 ,
Article 2.

Available at: <https://www.researchtrends.com/researchtrends/vol1/iss35/2>

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Section 1:
Country Trends

The bibliometrics of the developing world

Sarah Huggett

What is a “developing country”?

According to the Oxford English Dictionary, the developing world consists of “those countries of the world which are poor and not fully industrialized, but are seeking to become more economically and technologically advanced” (1). There is some controversy around the use of the term (2), as it may be perceived to imply inferiority of a “developing” versus a “developed” country, and also because it assumes a trend towards development along the traditional Western model that may not occur by choice or circumstance. Nevertheless, the

term is broadly accepted, and in this article used only to define those countries that may perhaps have historically had fewer resources to devote to research and scholarly communications than others. For the purpose of this analysis, the list of countries used was derived from the International Monetary Fund World Economic Outlook April 2013 (3). Whole counting of publications was used, so that each co-authorship equates to an article count. This means that co-publications between the developing world and the developed world are counted towards the developing world’s output, and vice-versa.

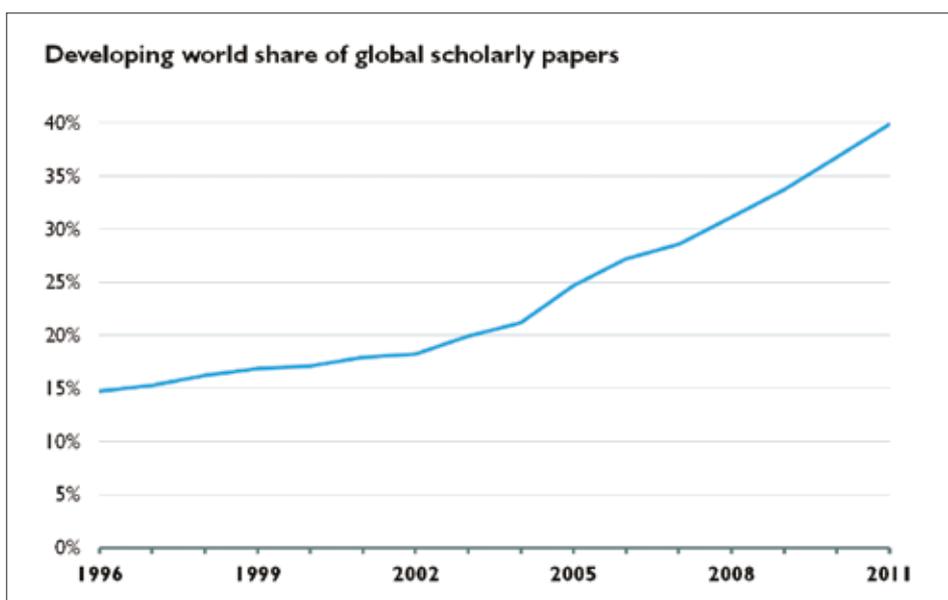


Figure 1: Historical overview of developing world share of global scholarly papers. Source: [Scopus](#)

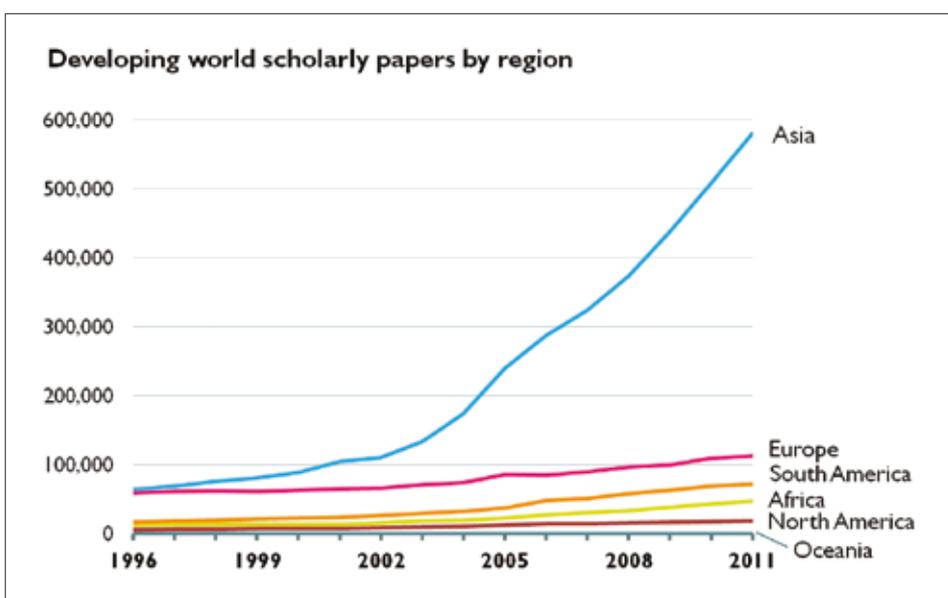


Figure 2: Historical overview of developing world scholarly papers output by region. Source: [Scopus](#)

Recent bibliometrics developments for the developing world

In 2011, the developing world published over 830,000 scholarly papers, representing just under 40% of the world's scholarly output. These countries have indeed been developing in both absolute and relative terms, as demonstrated by their increasing share of global scholarly papers (see Figure 1). The output of the developing world grew at 15% Compound Annual Growth Rate (CAGR) from 2002 to 2011, compared to 6% CAGR globally.

Looking at a historical overview of the developing world's scholarly publications by region reveals that most of the growth is concentrated in Asia (see Figure 2). A large proportion of the rise is due to China, which grew from an already large 17.3% of the developing world's scholarly papers in 1996 to a very prominent 43.9% in 2011, with an impressive 15% 2002-2011 CAGR. The three next most prolific developing countries are the other BRIC countries, but their shares of the developing world's output in 2011 are far behind China's with 9.9% for India with a strong 14% 2002-2011 CAGR, 5.7% for Brazil with a high 13% 2002-2011 CAGR, and 4.5% for Russia with a very low 2% 2002-2011 CAGR. The only other developing country with more than 4% of the developing world's 2011 output is Iran at 4.2%, with a tremendous 33% 2002-2011 CAGR.

And the developing world's scholarly output has not only been growing in quantity, but in citability as well, as demonstrated by a historical overview of its five year field weighted relative impact, a measure of citation impact relative to global citation impact. For 2011, this is calculated as a ratio of 2007-2011 citations to 2007-2011 scholarly papers, divided by number of 2007-2011 scholarly papers, then normalized to expected impact worldwide, accounting for different citation patterns in different fields. Although this measure is still under the world average of 1 at 0.70 in 2011, it has grown both absolutely and relatively from 0.52 in 2000 (see Figure 3). To put it in a nutshell, the developing world has grown from about half as impactful as the global average, to more than two thirds as impactful as the global average. This increase may be partly due to increased international collaboration between developing and developed countries over the years.

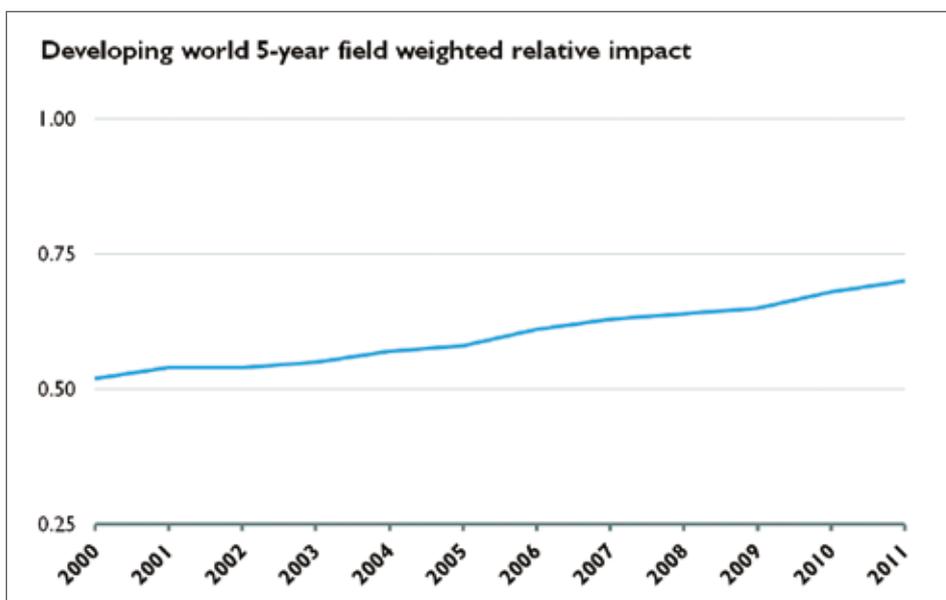


Figure 3: Historical overview of developing world five year field weighted relative impact. Source: Scopus

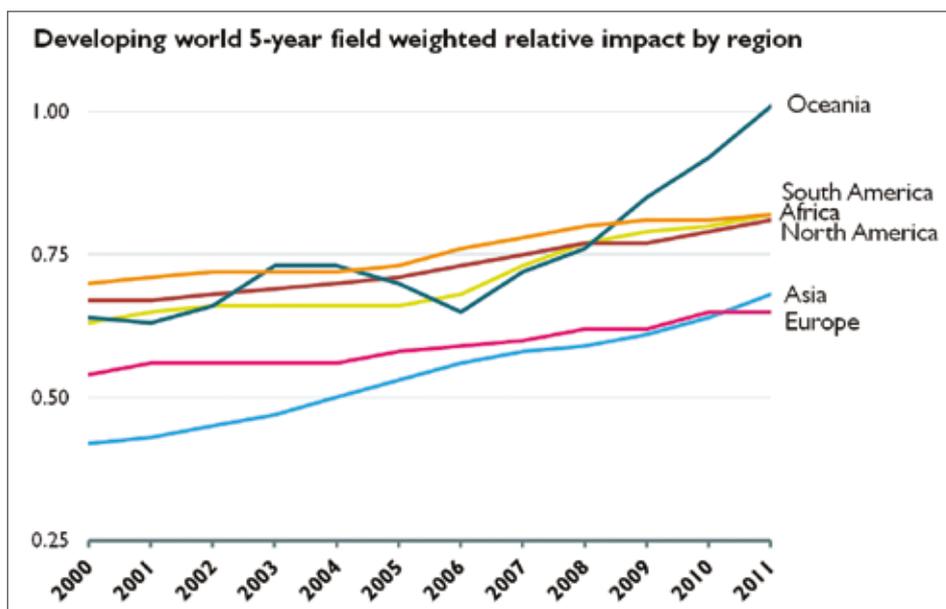


Figure 4: Historical overview of developing world five year field weighted relative impact by region. Source: Scopus

Looking at a historical overview of the developing world's five year field weighted relative impact by region reveals that growth in impact is not tied to growth in output (see Figure 4). Indeed, two groups emerge, with developing countries in Africa and the Americas showing relatively high field weighted relative impact at around 0.8 in 2011, while developing countries in Europe and Asia have a lower field weighted relative impact of respectively 0.65 and 0.68 in 2011.

However the trends for developing countries in these two regions differ: Asia has shown faster growth, so that while Asia's field weighted relative impact was notably inferior to Europe in 2000, it caught up with Europe in 2010 and outpaced it in 2011. Developing countries in Oceania have the highest field weighted relative impact and reach above world average at 1.01 in 2011, but their output is relatively small with only 334 scholarly papers published in 2011.

Subject trends for the developing world

The scholarly output of the developing world has been quite stable in its composition of various subject areas over time (see Figure 5). Over half (53.7%) of the papers published in 2011 by authors from developing countries are in the Physical Sciences. The rest of the papers are mostly divided between Life Sciences (21.5%) and Health Sciences (17.9%), accounting together for nearly 40% of the developing world's 2011 scholarly output. By contrast, the developing world is not very prolific in the Social Sciences (5.3% of its 2011 scholarly papers).

A comparison of developed versus developing world scholarly output by main field reveals some interesting patterns. Overall, the developed world's output follows a similar distribution pattern as the developing world, but appears less unequally distributed across main fields. Even if for both worlds, Physical Sciences is the most prolific area, it represents less than half (43.9%) of the developed world's output. A larger proportion of the developed world's output is in the Life Sciences (28.0%) or Health Sciences (31.4%), accounting for nearly 60% of the developed world's 2011 scholarly output. And while Social Sciences (13.6%) is still the least prolific area, it represents more than double the proportion of scholarly output for the developed world than for the developing world.

Given the vast differences in number of papers published by different regions, the developing world aggregate is skewed by the dominating output from Asia. Looking at the distribution of 2011 scholarly publications by main field for developing countries in each region reveals a more diverse picture (see Figure 6). Developing countries in Europe and Asia show a similar pattern to the aggregate, which they influence heavily due to the large number of papers they publish relative to total developing world scholarly output. In these regions, the scholarly output of developing countries is heavily geared towards the Physical Sciences (~60%), followed by Life Sciences (~20%) and Health Sciences (16%), with a much lower share for Social Sciences (~5%). Developing countries in other regions show a more balanced distribution: although Physical Sciences is still

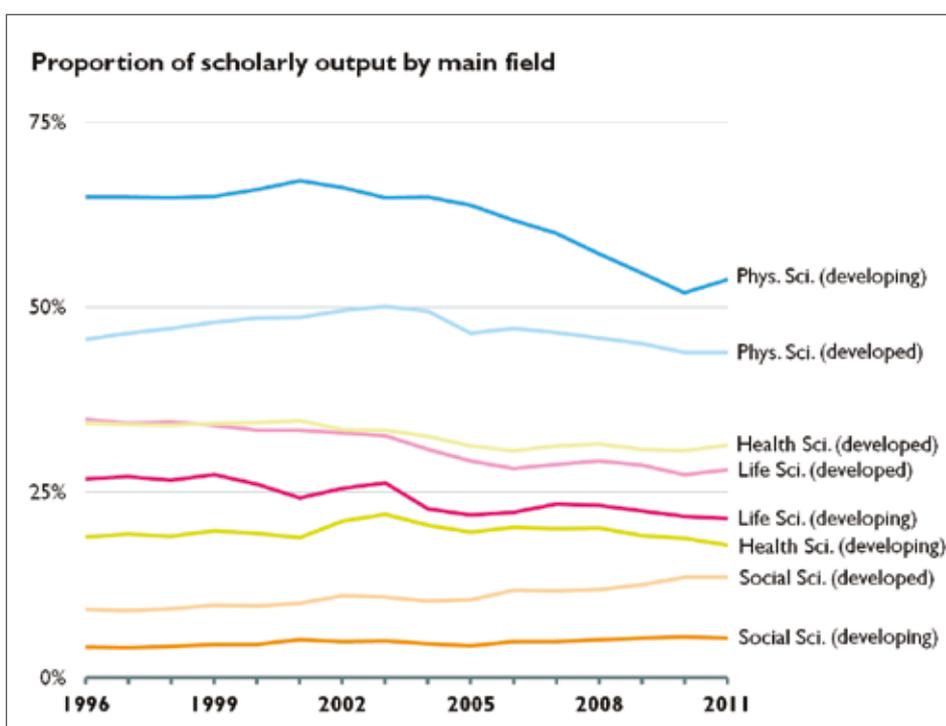


Figure 5: Historical overview of the distribution of the developed and developing worlds' scholarly output by main field. Source: Scopus

the most prolific field for developing countries in North America, Africa, and South America, these papers represent 32-38% of each region's output, leaving larger shares to Life Sciences (~30%) and Health Sciences (25-29%). Developing countries in these regions also show a higher proportion of Social Sciences papers (~8%).

This distribution of 2011 scholarly publications by main field for developed countries in each region again shows similar but more balanced patterns (see Figure 7). North America displays the fewest divergences between developing and developed countries amongst regions with enough data for robust results. A third of the scholarly output of developed countries in North America is in the Physical Sciences (-5 percentile points compared to developing countries), a quarter in the Life Sciences (-4 percentile points compared to developing countries), 28% in the Health Sciences (+3 percentile points compared to developing countries), and 14% in the Social Sciences (+6

percentile points compared to developing countries). While the output of developed countries in Asia is still predominantly in the Physical Sciences, this represents just under half of their scholarly output (-11 percentile points compared to developing countries). The share of Life Sciences and Social Sciences scholarly papers in this region is similar to those in developing countries at respectively 22% and 6% (2 percentile points higher than developed countries each). However, developed countries in Asia publish proportionally more in the Health Sciences (23%) than developing countries (16%). The differences are even more blatant for Europe: Physical Sciences account for 38% of scholarly papers (21 fewer percentile points than in developing countries in this region), allowing for higher shares in Life Sciences (24% (+5 percentile points compared to developing countries)), Health Sciences (27% (+11 percentile points compared to developing countries)), and Social Sciences (11% (+5 percentile points compared to developing countries)).

Future development for the developing world

In bibliometric terms, the developing world has indeed seen some development over the past few years, both in absolute and relative terms. Although the developing world is still heavily dominated by the BRIC countries in terms of quantity of scholarly papers published, it achieves higher impact with research published from Africa and the Americas. Regional differences also occur in terms of the distribution of content published by main field, with Europe and Asia showing a marked prominence in the Physical Sciences.

The developing world appears to be a combination of varied entities with different specifications when it comes to scholarly output, and its recent growth trends for both quantity and impact bode well for its future, although the distribution of future successes may be unequal between different developing countries.

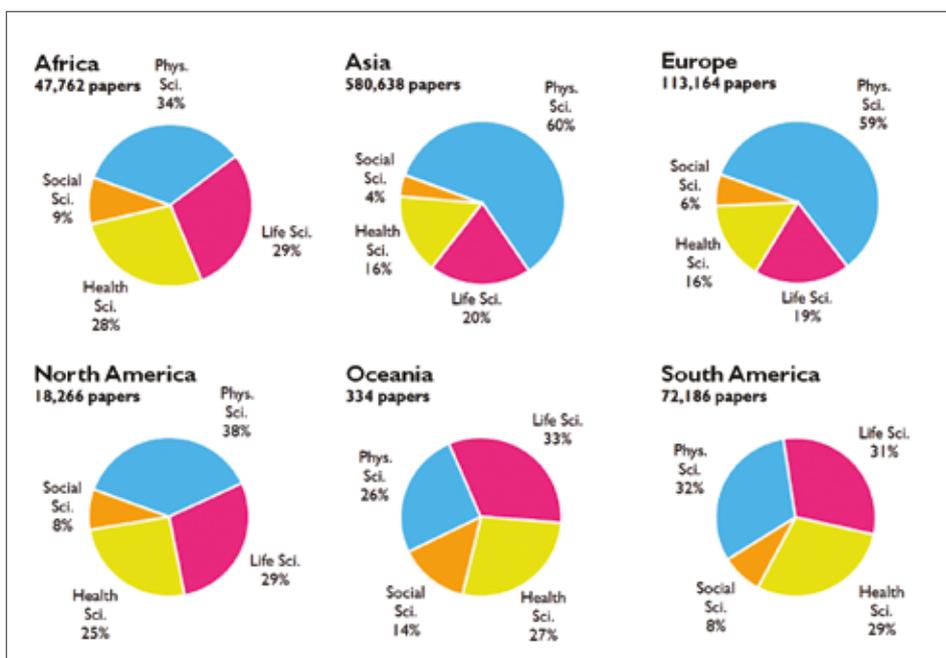


Figure 6: Distribution of developing world 2011 scholarly papers by region and main field. Source: Scopus

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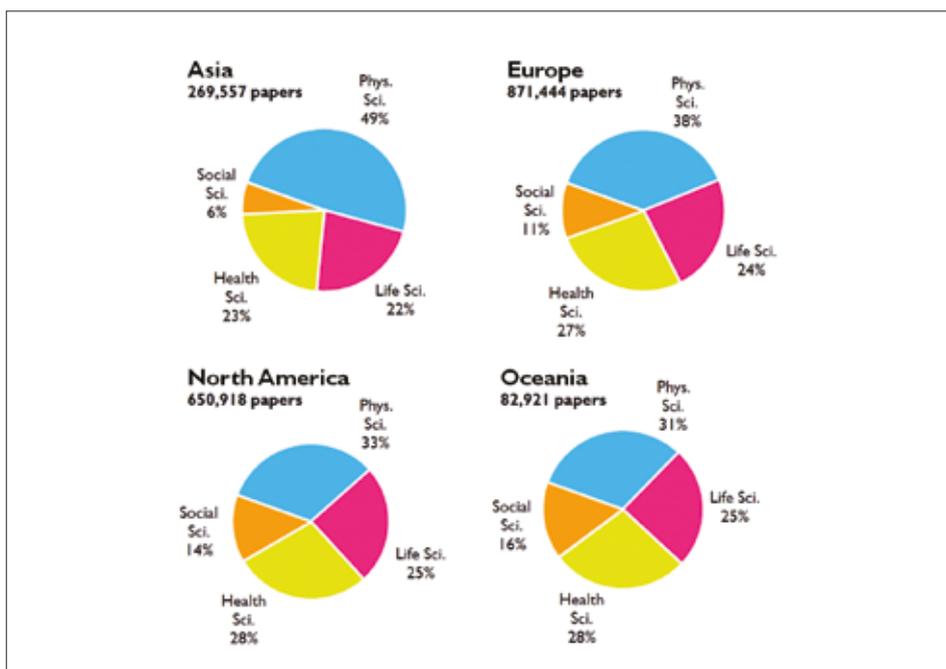


Figure 7: Distribution of developed world 2011 scholarly papers by region and main field. Source: Scopus